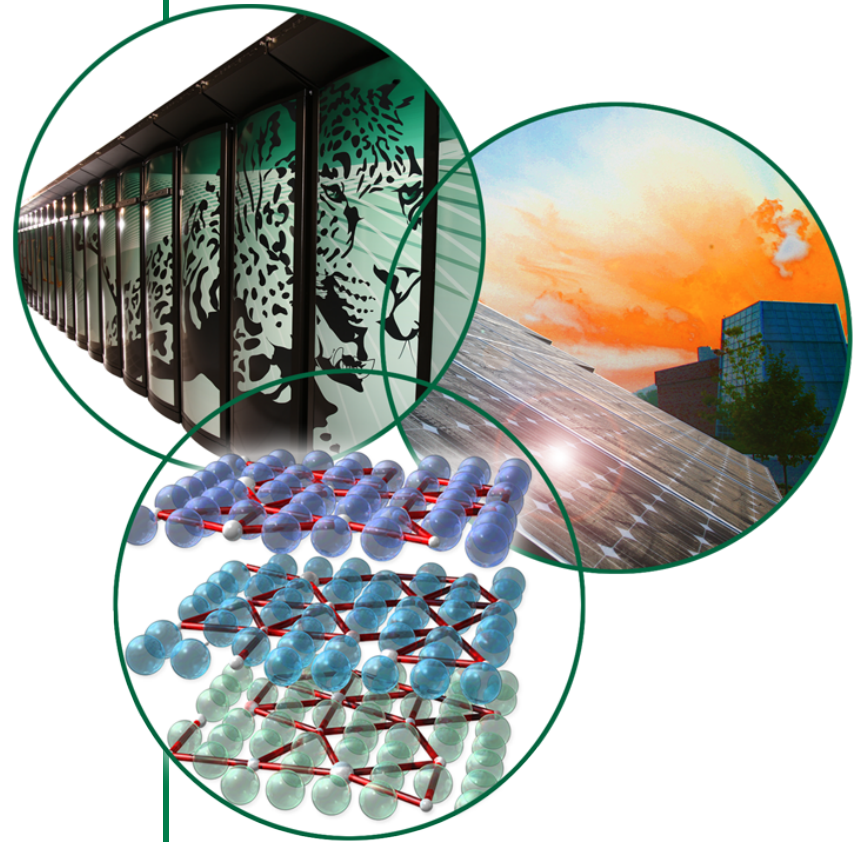


# US DOE Nuclear Criticality Safety Program Training and Education Project

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 **OAK RIDGE NATIONAL LABORATORY**  
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

# **Development and Progress of the Two-week US DOE NCSP T&EP Course**

- **Vision**
- **Mission**
- **Course description**
- **Crucial factors for success**
- **Timeline for implementation**

# US DOE NCSP T&EP Vision<sup>(1)</sup>

- Be a continually improving, adaptable, and transparent project that is responsive to the essential training and educational needs of DOE facility staffs that are responsible for developing, implementing, and maintaining nuclear criticality safety programs
- Identify, develop, provide, and promote practical and excellent technical training and educational resources that foster competency in the art, science, and implementation of nuclear criticality safety and are adaptable and responsive to the needs of those responsible for developing, implementing, and maintaining criticality safety

*<sup>(1)</sup> The Mission and Vision of the United States Department of Energy Nuclear Criticality Safety Program for the Fiscal Years 2009 – 2018, (<http://ncsp.llnl.gov/NCSP-MV-COMPRESSED.pdf>)*

# US DOE NCSP T&EP Mission

**The T&EP mission is to provide DOD or DOE security cleared or non-cleared nuclear criticality safety engineers and managers with quality uniform training and education regarding “hands-on” sub-critical and critical experiments training and classroom education on the application of DOE HQ interpretations and positions regarding such topics as regulations, guides, orders, standards, utilization of non-destructive analysis results, safety evaluations/analyses, and other topics as judged appropriate by the DOE NCSP Manager**

## **ORNL Rolls are to:**

- **Identify and develop T&EP course objectives and content needs (i.e., gaps in available training and depth of training)**
- **Provide overall coordination of T&EP Pilot Course development and execution in FY11**
- **Assist in the critique of the Pilot Course offerings**
- **Support the transition of the Pilot Course to routine presentations in FY12**
- **Assist in the morphing of the 2-week nuclear criticality safety engineer T&EP course into a condensed safety managers and VIP T&EP courses**

# **T&EP General Course Objectives\***

- **Provide a DOE consistent level of DOE interpretation, understanding, awareness and applications regarding**
  - DOE Orders, Guides, ANS Standards, Rules
  - Performance of Criticality Safety Evaluations
  - Hazards Analysis Methods and Implementation/maintenance of NCS Controls
- **Ensure versatility for cleared and un-cleared students**
- **Provide alternate/backup facility capabilities for hands on training**
- **Provide experimental hands-on training addressing**
  - Characteristics of Neutron Multiplying Systems
  - Discussion of
    - Theory
    - Implications for the Safety of Fissionable Material Operations

**\* CSSG Tasking 2009-03, Recommendations for the Future DOE NCSP Training and Education Infrastructure Program**

# **T&EP Specific Course Description** (1<sup>st</sup> week)

1. Facility access training necessary for the full 2-weeks of the course (SNL, LANL, CEF)
2. Tours of the Los Alamos National Laboratory TA-55/PF-4 (LANL)
3. Review of ANSI/ANS-8.XX standards and their applications to DOE NCS programs (LANL)
4. Explanations and example applications of DOE HQ interpretations of DOE rules, standards and guides, and national consensus standards (CSCT)
5. Examples of human factors and equipment reliability relative to typical fissionable material process operations (SNL or INL)
6. Hazards analysis (LANL)
7. Interpretation and application of non-destructive analyses (NDA) methods and results to nuclear criticality safety evaluations (NSL-ORNL)
8. Exercises in the preparation of DOE-STD-3007-2007 compliant criticality safety evaluations (LANL) that integrate topics 2. – 7.

# T&EP Specific Course Description (2<sup>nd</sup> week)

- Tour experiments facilities (SNL, CEF)
- Receive SNL or CEF classroom refresher training and education in
  - Reactor theory, subcritical multiplication, inverse multiplication techniques, and nuclear instrumentation,
  - Sub-critical & Critical experimentation
    - Historical perspective
    - Accident scenarios
    - Lessons learned
  - Development of experimental plans
  - “Hands-on” sub-critical experiments
  - Remote assembly critical experiments
- Conduct supervised experiments (SNL or CEF)
- Analyze supervised experiments results (SNL or CEF)



# Success is Dependent Upon Timely Integration of

- DOE and contractor personnel intellectual resources and products
- Access and use of DOE physical resources
- Administrative planning and support
- Fiscal support

# Intellectual Resources and Products include DOE HQ, Site, Laboratory and Facility Personnel to

- Prepare and deliver classroom training and education materials regarding
  - Facility Access Training for
    - TA-55/PF-4 (LANL)
    - NNSS CEF (CEF)
    - Sandia Pulsed Reactor Facility (SPRF) Critical Experiment (CX) (SNL)
- Integrate DOE HQ regulatory interpretations as applied to standards, guides, and orders, and utilization of hazards analysis, human factors & equipment reliability, and non-destructive analyses into NCS evaluations/analyses (CSCT)
- Conduct of TA55/PF4 tour(s) and use of DOE-STD-3007-2007, DOE Standard Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Nonreactor Nuclear Facilities (LANL)
- Perform Hands-on critical and sub-critical experiments for
  - NNSS CEF (CEF)
  - SPRF/CX (SNL)
- LANL, CEF, and SNL verify (e.g., exercises, tests, demonstrations, oral responses) student comprehension of
  - Prerequisites for attending the T&EP training and education
  - Classroom training and education
  - Hands-on experiments training and education

# DOE Administrative and Physical Resources

- Supervised access to LANL TA-55/PF-4 (LANL)
- Access to and use of classroom facilities at:
  - LANL (LANL)
  - SNL (SNL)
  - NNSS CEF (CEF)
- Supervised access to and use of:
  - NNSS CEF critical and/or sub-critical experiments equipment (CEF)
  - SPRF/CX equipment (SNL)
- Lodging and transportation
  - Los Alamos, NM (Lodging ↔ Classroom ↔ TA-55/PF-4) (Students)
  - Albuquerque, NM (Lodging ↔ Classroom ↔ SPRF/CX) (Students)
  - Las Vegas/Mercury, NV (Lodging ↔ Classroom-CEF) (CEF)

# **Administrative Planning and Support: (LANL, SNL, ORNL, Subsequently LLNL)**

- **ORNL** for the T&EP planning and coordination
- **CSCT** for the development and presentation of training materials regarding the applications of DOE NCSP interpretations of DOE rules, standards and guides
- **NSL-ORNL** NDA Applications Team for the development and presentation of training materials regarding the application of non-destructive analyses (NDA) of fissile material holdup measurements results for nuclear criticality safety evaluations/analyses
- **SNL** or **INL** for the development and presentation of training materials for human factors and equipment reliability

# **Administrative Planning and Support: (LANL, SNL, ORNL and Subsequently LLNL) (cont.)**

- **LANL for the:**
  - **Coordination of classroom facility access training presentations that are developed by LANL (for TA-55/PF-4), SNL (for SPRF/CX) and NNSS (for CEF)**
  - **Development and presentation of training materials regarding:**
    - **exercises in applying DOE-STD-3007-2007 to operations in TA-55/PF-4**
    - **review of ANSI/ANS-8.XX standards**
  - **Timing Coordination of classroom training presentations developed by**
    - **LANL for the performance of DOE-STD-3007-2007 compliant criticality safety evaluations**
    - **DOE CSCT for presenting NCSP interpreted applications of DOE rules, standards and guides**
    - **ORNL NSL for presenting training in the applications of NDA to NCS evaluations**
    - **LANL for presenting:**
      - **hazards analysis methods and implementation/maintenance of NCS controls**
      - **ANSI/ANS-8.XX standards review**
    - **SNL or INL for presenting human factors and equipment failure frequency**

# **Administrative Planning and Support: (LANL, SNL, ORNL and Subsequently LLNL) (cont.)**

- **SNL** and **NNSS CEF** for the collaborative coordination of uniform learning objectives and subject matter for the “hands-on” sub-critical and remote critical experiments training and education at separate facilities
- **NNSS CEF** for exploring/arranging student logistics (e.g., lodging and transportation for the NNSS CEF “hands-on” training course)
- **LANL** and **DOE NCSP** approval for non-cleared students to access the LANL TA-55/PF-4 and NNSS CEF

# T&EP Implementation Timeline

- RFPs solicited from potential contributing organizations Q1 & Q2 FY10 (9 contractors, 5 universities, 5 labs, 2 individuals)
- RFPs evaluated Q3 FY10
- Selection of program contributors completed Q4 FY10



perhaps



- Collaborative planning begun Q4 FY10
- DOE NCSP T&EP 5-year plan submitted Q3 FY10
- T&EP Strategic Plan submitted Q4 FY10
- T&EP schedule & calendar distributed Q2 FY11
- Pilot T&EP courses scheduled for completion Q4 FY11
- 6 – 8 Classes anticipated for FY12

# Reminder

*This Course is to supplement NCSE training and education that is typically not available from the employer*

**(i.e., hands-on critical and sub-critical experiment training in experiments facilities, education in DOE Headquarters regulatory interpretations, and expectations for site nuclear criticality safety programs – e.g., review of process criticality accidents, criticality safety evaluations, computations education)**



# T&EP General Course Description

DOE NCSP Nuclear Criticality Safety Engineer (NCSE) Supplemental Training and Education Program (T&EP)	
Overview	The DOE NCSP NCSE T&EP is specifically developed to establish, train, and support consistent hands-on training and regulatory expectations, interpretations, and applications within the DOE contractor community.
Purpose	This Course will supplement NCSE training and education that is not available from the employer (e.g., hands-on critical and sub-critical experiment training in experiments facilities, education in DOE Headquarters regulatory interpretations, and expectations for site nuclear criticality safety programs).
Audience	U. S. Department of Energy and contractor personnel, consulting personnel in commercial enterprises preparing and reviewing criticality safety operations, evaluations, and/or performing program reviews for DOE contractors.
Prerequisites	Background in sciences and engineering and completion of identified prerequisites.
Content	<ul style="list-style-type: none"> <li>• Education about DOE nuclear criticality safety (NCS) program regulatory <ul style="list-style-type: none"> <li>○ interpretations</li> <li>○ Expectations</li> </ul> </li> <li>• Review of ANSI/ANS-8.XX standards and their relevance to DOE NCS programs</li> <li>• Introduction to: <ul style="list-style-type: none"> <li>○ Hazards analysis</li> <li>○ Application of NDA measurements and results to criticality safety evaluations</li> <li>○ Human factors and equipment reliability</li> </ul> </li> <li>• Field observations and class exercise in performing DOE-STD-3007 criticality safety evaluation</li> <li>• Confirmation of student comprehension through monitored and documented classroom and laboratory exercises, observations, and tests</li> <li>• Instruction on <ul style="list-style-type: none"> <li>○ performing critical and/or sub-critical measurements <ul style="list-style-type: none"> <li>▪ theory and characteristics of neutron multiplying systems</li> <li>▪ implications for the safety of fissionable material operations</li> </ul> </li> </ul> </li> <li>• Guidance in the performance and analysis of hands-on critical and/or sub-critical measurements</li> </ul>
Duration	80 hours over two weeks.
Method of Instruction	This is an in-experimental-facility hands-on training and classroom education Course consisting of instruction, presentations, experimental exercises, small group problem solving, and knowledge assessment/evaluation of crucial concepts supporting criticality safety evaluations and programs.
Course Materials	Students receive a copy of all Course viewgraphs, selected reference documents. An evaluation form and a Certificate of Training are distributed upon completion of the Course. Mandatory comprehension evaluations are performed to evaluate the student's grasp of the training and education material presented in the Course.